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ABSTRACT

This article describes how the author's infant son enthusiastically played with buttons from the age of 5 months to his first birthday. The article details his play routines and how they changed over time. It draws on recent neurological research about how the brain grows to argue that this play provided the foundation for her son's cognitive and emotional growth and development. The article then examines how the brain functions and demonstrates how the infant's play helped him learn how to learn. Next, the article discusses the role of emotions in learning and how the button jar may have facilitated her son's emotional development. Finally, the article lists guidelines to facilitate infants' cognitive and emotional growth and enhance learning potential; and notes implications for Reading Recovery teachers, including a list of suggestions. (SR)

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Cognitive and Emotional Development of the Mind: Insights from Playing the Button Jar Game.

by Carol A. Lyons

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Cognitive and Emotional Development of the Mind: *Insights from Playing the Button Jar Game*

CAROL A. LYONS, THE OHIO STATE UNIVERSITY

The button is a common practical object that most people use regularly throughout their daily lives. We generally give little thought to these ordinary things, except perhaps when we cannot button our pants or blouse because one is missing. Yet, these mundane objects were the center of my son's world from the time he was 5 months old until his first birthday. And after thinking about the many hours the two of us sat on the floor and talked while playing "the button jar game," I suspect that playing with buttons contributed greatly to his cognitive and emotional growth and development. For me, buttons are powerful symbols, full of childhood and parenthood memories and meaning.

Grandma Mueller made most of my clothes until I entered third grade. When I was about four years old, I started going with Grandma to the Marshall Field's Store to help her pick out the McCall pattern, fabric, thread, and buttons for my outfits. I liked to find unusual buttons that had different colors, shapes, textures and sizes. I especially enjoyed getting "fancy buttons" which had pictures of animals, flowers, clowns, and holiday figures. After Grandma made my dress or overalls, it was my job to help her sew the buttons on the outfits. Buttons we did not use were put into a large glass pickle jar.

I inherited Grandma's sewing machine, sewing box, and gallon glass button jar 27 years ago as part of her household goods. I convinced my husband (who was not thrilled with the idea) to rent a U-Haul trailer so that we could transport the sewing machine and button jar from Milwaukee, Wisconsin, to Bristol, Connecticut. Not knowing how to operate the sewing machine, I stored it and the large glass button jar in a spare bedroom.

When Kenny, our son, was five months old, he started to crawl. Once on the floor, he immediately went into the spare bedroom. He spied the button jar and made squealing noises until I put it on the floor. Then, while making babbling sounds, Kenny would try to touch the buttons through the glass. He seemed to be fascinated with the many colors, sizes, and shapes of the hundreds of buttons that filled the jar.

After several days of looking and trying to touch the buttons through the glass, Kenny's gestures and loud babbling sounds suggested that he wanted to feel those colored objects. I unscrewed the lid, turned the jar over, and dumped a few of the larger buttons on the hardwood floor. With dancing eyes and loud screeching noises, Kenny watched and listened to the clicking and tapping sounds as the buttons scattered across the floor. He immediately started to crawl after them and attempt to pick them up. However, his fingers were too little, so with my help we pushed each button into one pile. He would listen to the swishing sounds as we stirred the buttons around on the floor and let them fall through our fingers. Then, with me doing most of the work, one-by-one we returned the buttons to the jar. The following play routine lasted about three weeks.

Kenny crawls into the spare bedroom and, making loud noises, "asks me to come into the room." I come. He points to the glass button jar and through gesture while babbling directs me to put the jar on the floor. I com-

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ply. Then watching my every move, he talks (babbles) to himself in an excited way as I unscrew the lid and spill between ten and fifteen of the larger buttons on the hardwood floor. Kenny watches closely as the buttons scatter across the floor, crawls after each one, and tries to grasp them with outstretched fingers. He has the idea, but not the coordination, to place his fingers around the button to pick it up. After several unsuccessful attempts, I pick the button up and show him how to hold it. As soon as it is placed in his hand, Kenny tries to put the button in his mouth. I prevent him from accomplishing this action, pull his hand away from his mouth while telling him the button is not food and if he eats it, he will get sick. After giving me that "poor me" look, we put the button in the jar.

On one occasion, however, he did manage to put the button in his mouth. After taking it out, I told him in a very firm way that the next time he tried to put a button in his mouth, the button jar would be put away and the game would end. The very next day he tested my warning and learned early on that what I said, I meant. The button jar was put away and our routine ended for several days. Everytime he went to the spare bedroom and pointed to the jar, I would shake my head and say, "You can touch the buttons after you promise not to put the button in your mouth. One day when I asked Kenny if he was going to put a button in his mouth, he shook his head indicating no and our game resumed.

When Kenny was able to successfully push the buttons in one pile without my help, I showed him how to sort the buttons by size and color. I was careful to link the language I was using to the action taking place. For example, I would say "let's put all the big buttons into this pile and the little buttons here," as we pushed them into the appropriate group. With my help and accompanying talk about what was happening, Kenny learned how to sort buttons by color and size. By the time he was eight months old, Kenny had learned how to associate a word to identify different piles of colored buttons, but he could not yet produce the word to let you know how he classified them.

After he learned to sort buttons by color and size, I showed him how to count the buttons in each pile. When he was 10 months old, Kenny pointed out that some of the buttons had holes and others had no holes on top. Some buttons had two holes, others had four holes. Ken, not me, had discovered another classification system. The more he touched the buttons, the more sensitive he became to how they felt. Some were shiny and smooth, like the brass buttons on Dad's sport coat; others were dark and rough, like the buttons on Mom's black winter coat. He had not acquired a word to label the concepts, but he noticed differences and similarities among buttons, thus completing the task visually. It was not until he was one, however, that Ken could use a word (e.g., smooth, shiny, red) to describe how each button looked and felt.

Ken never seemed to be bored playing the button jar game. As he became more adept at classifying the buttons by shapes, colors, number of holes etc., I decided to make the game more challenging. I introduced him to "Can I trick you?" In this game, two different categories were used to group the buttons. Kenny had to examine each group of buttons and identify the categories. For example, I would place all the black buttons with four holes into one pile and animal buttons with no holes into another pile. Kenny would look at the piles and identify the category systems used to group the buttons. After several weeks playing this game, he wanted to sort the buttons into different category systems and try to trick me. We continued to play this "Can I trick you," increasing the number of category systems in which to group the buttons, until he was almost two years old.

As he became more competent playing "Can I trick you?" another dimension was added to the game. I would put a red button into the white pile and ask him what's wrong, pretending that I did not understand the problem. Ken, squealing and laughing, would take the red button out of the white pile and tell me I was wrong and show me where the red button should go. Then it would be his turn to try and confuse me. His plan for tricking me,however, was always revealed in his self-talk. For example, he would whisper that he was going to put a white button in the red pile and then watch to see if I caught his error. I would pretend I did not know what was wrong and he would laugh with delight and then tell me his mistake. In his

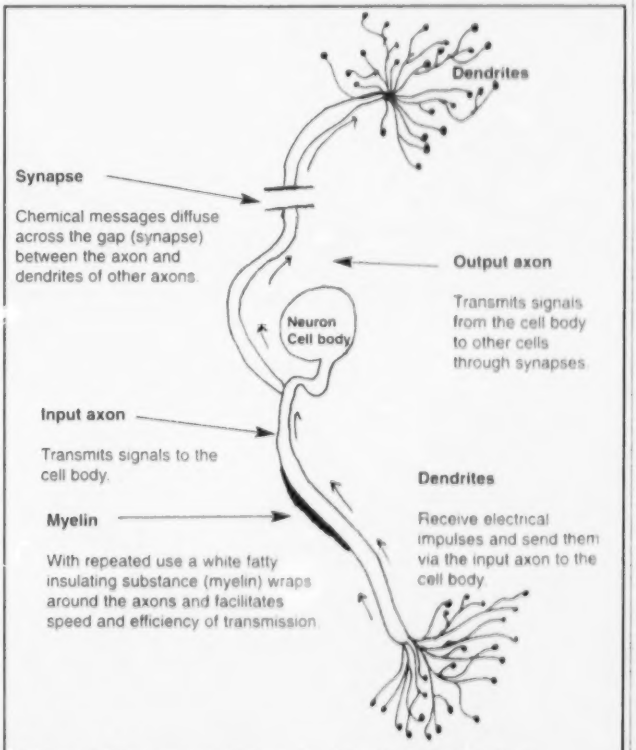
Dendrites
Synapse
Chemical messages diffuse across the gap (synapse) between the axon and dendrites of other axons.
Output axon
Transmits signals from the cell body to other cells through synapses
Neuron Cell body
Input axon
Transmits signals to the cell body.
Dendrites
Receive electrical impulses and send them via the input axon to the cell body
Myelin
With repeated use a white fatty insulating substance (myelin) wraps around the axons and facilitates speed and efficiency of transmission.

Figure 1: The transmission of signals (information) through one neuron.

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baby book I wrote that at 12 months of age, Kenny's and my favorite thing to do was playing games with the buttons in Grandma's button jar.

What did Kenny learn while playing the button jar game during his first year of life? Recent neurological research (Damasio, 1994; LeDoux,1996) suggests that these experiences may have provided the foundation for cognitive and emotional development that impacted his learning potential and future for a lifetime. In the following section, I will discuss how and why this may have occurred.

How the Brain Grows

The billions of tiny active units making up the nervous system are nerve cells, *neurons*, and *glial* cells. The neuron cells are designed to communicate electrochemically with one another. The noncommunicating glial cells support, nourish, and insulate the neuron cell.

Each neuron has a cell body that contains many short, hairlike tubular receptors called *dendrites* that receive information from other neurons and a taillike axon extension that sends the neuron's message to other neurons. The neuron receives electrical signals with its dendrites from the axons of neighboring neurons and sends the signal down its own axon to others via chemical junctions called synapses. Synaptic connections, where learning begins, are strengthened by repeated use (Healy, 1994).

As electrical messages are processed over and over again, the neuron matures and the axons, over which messages travel to other cells, become coated with *myelin*, an insulating fatty substance that helps the efficiency and speed of transmission. Before *myelination*, messages travel haphazardly and inefficiently. There is little myelin present at birth, and it takes twenty to thirty years to finish the process. Myelin formation enables more efficient brain use.

Babies are born with over 100 billion neurons that become organized into systems for perceiving, hearing, talking, touching, thinking, and remembering. At birth these basic neural networks are already operating. Individual neurons are responding to stimuli seen, felt, heard, touched, and tasted, and then transmit these signals to other neurons. We do not teach a child to recognize familiar faces or voices; we provide opportunities for adaptations to the neural system that is already operating.

Learning becomes a powerful dialogue between genetics and environment. Stimulating experiences create complex reciprocal connections among neural networks (Sylwester, 1995). Recent research (Greenspan, 1997) has demonstrated that the growth of these neural networks—and the quality of individual's thought—is directly related to the child's environmental experiences.

As soon as Kenny started to crawl, he would head for the spare bedroom. I believe his motivation was Grandma's colorful button jar. He was especially excited when the sun was shining and the colors reflected off the walls. Research (Healy, 1994) shows that initially most input for the infant is through visual and motor systems each of which have complex neural structures.

At first, Kenny needed my help to push the buttons into a pile. We pushed the buttons in a slow deliberate way and I organized the experience. After several weeks of routine and daily practice, he did not need my help. Kenny was able to crawl to a specific button, reach for it, touch it, and move it to a designated place on the floor. I watched and talked about what he was doing as he pushed the buttons into piles.

According to Healy (1994), moving objects slowly builds visual connections and knowledge about space. Research suggests that engaging in activities that involve a variety of patterns, textures, and colors may help integrate sensory experience. Describing and talking about the action as it occurs links auditory and visual input. Learning to focus on one or more sensory modalities (motor, visual, and auditory) requires maturation and practice.

As Kenny became more skillful and confident completing one kind of activity, task difficulty increased. For example, he learned how to

- organize and coordinate his hand and fingers and thumb in order to pick up a button, and sort buttons by size and color and push them into separate groups;
- produce a word (e.g., red) to identify a specific group of buttons;
- count the number of buttons in each pile;
- recognize similarities and differences among buttons;

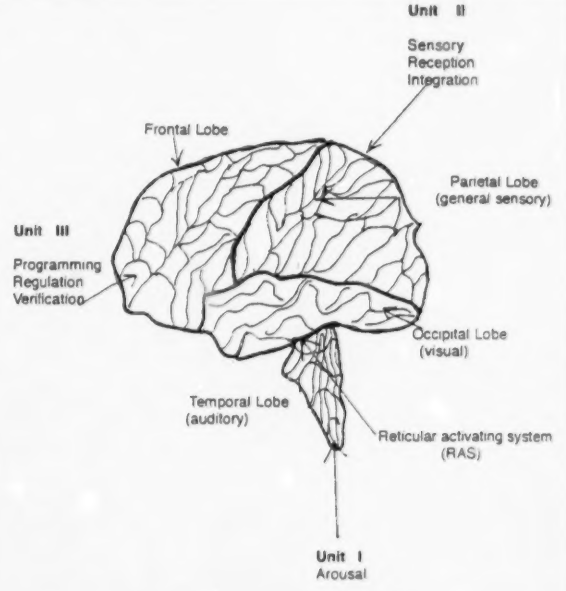

Figure 2: The functional organization of the brain, A. Luria.

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- group buttons using two or more classification systems (color and texture);
- recognize another person's classification system;
- plan and create a problem to have another solve;
- regulate his actions through self-talk.

Research (Greenspan, 1997) reveals that the types of stimulation infants receive in the environment have dramatic effects on the neural growth and cognitive and emotional development. As raw material for thinking and learning, nature equips the infant's brain with an excess of neurons. Healy (1994) writes:

> **At birth, much cortical tissue is uncommitted, "plastic" in its ability to develop. Even while the brain grows rapidly during the first two years of life, extra neurons are dying off as cells compete to make connections. When an activity is carried out, the brain stimulates itself to repeat the neural relays involved. (p. 37)**

Each child must build individual neural networks for thinking: this development comes from within, using outside stimuli as material for growth (Healy, 1994). I believe that playing with Grandma's button jar activated various neurons in Ken's brain in such a way as to myelineate axons and create many dendrictic branches for each neuron. Speed and efficiency increased with repetition and daily routine. Task difficulty increased as Ken's competencies increased. He had the opportunity to select, wonder, experiment, and act, and in the process build his neural network.

How the Brain Functions

Luria (1973) proposed that learning involves three distinct but interrelated functional units of the brain. Unit 1, located in the brain stem, is responsible for arousal and regulating wakefulness. The *reticular activating system* (RAS) located in Unit 1 at the top of the brainstem serves as a gatekeeper, allowing stimuli to enter the brain and to be relayed through the limbic systems to the appropriate cortical regions of the brain. The RAS plays a powerful role in directing and sustaining attention. Attention is the foundation of learning. For most cognitive actions, individuals have voluntary control over the RAS.

Ken's initial interest in seeing and touching the buttons and his ability to sustain attention in subsequent activities occurred because he determined the stimuli to let into or keep out of consciousness. While playing with the buttons, Ken learned how to focus, regulate, and sustain attention.

The second functional unit of the brain includes the occipital lobe (vision), temporal lobe (hearing, both auditory stimuli and language), and parietal lobe (touch, motor, and spatial understanding). These three lobes serve as short-term memory banks for auditory, visual, and motor activity. Each individual has instinctive drives to regulate the amount of auditory, visual, and tactile stimulation that come into the brain.

Activities that enable the child to integrate and coordinate functions of occipital, temporal, and parietal lobes of the brain facilitate neural and cognitive growth. Through play with the buttons, Ken learned how to integrate and coordinate actions that involved these three lobes of the brain. He learned to:

- Coordinate and control hand and eye movements while pushing buttons into groups.
- Integrate and connect gesture, touch, sounds, and words.

The third functional unit of the brain, located in the frontal lobe, is responsible for programming, regulation, and verification (Luria,1973). Luria believed that development of the frontal lobes, which control the attentional system (RAS), depends on using words to guide behavior. Through inner-speech children learn how to problem-solve and plan actions.

Varied experiences with the buttons provided opportunities for Ken to learn how to program, regulate and verify his actions. He learned how to

- See relationships among buttons and organize/classify them at the sensory level.
- Associate a specific word to describe a button.
- Recognize patterns, similarities, and differences among buttons.
- Categorize buttons into discrete groups according to a plan of action.
- Develop a flexible classification system to categorize buttons. (white, two-holes)
- Provide rationales for Mom's category system.
- Develop a feedback system to monitor behavior. (Catching Mom's and his own errors while putting buttons into specified groups).
- Use language (self-talk) to regulate his behavior.
- Correct his own behavior.

The combination and interaction of the *attentional system*—reticular activating system (RAS), the limbic system (emotional brain) and frontal lobes (cognitive brain)—is an important factor in a child's ability to learn how to learn. In the next section we take a closer look at the role of emotions in learning and how the button jar game may have facilitated Ken's emotional development.

How Learning is Enhanced: The Emotional Side

Attention is the foundation of learning. Individuals determine what they will and will not attend to because they control and regulate their reticular activating system (RAS). As the frontal lobes develop and mature, linkages are made to the RAS. The limbic system (emotional brain) also plays a critical role in attention. The limbic system is an integral part of the brain circuitry that activates and directs messages to the higher cortical regions (e.g. frontal lobes) of the brain. The RAS (gatekeeper), located in the brain stem, is responsible for arousal and along with the limbic system (emotional brain) creates a loop that regulates what is learned and how one feels about the learning experience. This loop acts as a feedback system that enables the learner to confirm, check, and/or correct behavior

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while at the same time have a positive or negative response to the learning experience. When material and/or tasks are too difficult, individuals oftentimes feel overwhelmed and anxious. When this occurs, they may have a flight or fight response and as a result the arousal system (RAS) shuts down, the child withdraws, and attention is greatly diminished (Goleman, 1997). Conversely, when tasks are easy but challenging and the individual feels safe and confident that he/she has a reasonable chance to meet with success, focused attention increases and opportunities to learn how to learn increase.

Recent research (Damasio, 1994; LeDoux, 1996; Pert,1997) reports that positive emotions facilitate chemical substances (neurotransmitters) in the brain that help messages cross synapses resulting in effective learning. Moreover, particular neurotransmitters (e.g., serotonin) are emitted when the child feels rested, successful, in control, and secure. Fear, anxiety, pressure, and exhaustion may make it impossible for the neurons to send or receive the designed signals. Well-intentioned parents may unwittingly short-circuit the neural pathways to cognitive and emotional development by forcing children to learn something they choose to teach. This tactic will backfire when children (and/or parents) become anxious and upset.

Infants need safety, love, and supportive conversations with their parents to facilitate brain growth. Active interest and mental effort by the child are major factors that facilitate the development of neural networks. Children want to please their parents and sense that their parents are happy with their developing competencies. Children who receive positive reinforcement and support are likely to become actively engaged and take risks when introduced to new tasks.

The following guidelines, adapted from Healy (1994), facilitate infant's cognitive and emotional growth and enhance learning potential.

- Get involved when you have time to be patient.
- Follow the child's lead. (The RAS will remain open)
- Let the child be the learner.
- Don't teach; facilitate.
- Make sure the child is actively interested and involved.
- Repeat an activity many times to firm up neural networks for proficiency ... as long as interest and engagement will allow.
- Provide positive encouragement for active exploration and investigation.
- Call attention to objects and help the child to focus on one sense at a time.
- Link specific language to specific actions.
- Provide opportunities for the child to interact with objects through auditory, visual, and/or tactile input.
- Talk while demonstrating. (Language is a means by which the brain develops its ability to act as a control center for thinking, learning, planning, and decision-making).
- Provide safety and protection in order to explore new objects and situations.
- Develop and abide by a set of rules.
- Provide a calm, caring environment with reasonable limits but without fear of punishment or failure.
- Provide stress-free loving interpersonal experiences and visual-spatial activities that involve touching, feeling, holding, and exploring objects.
- Establish firm limits.
- Establish predictable routines.
- Teach your child what "no" means, but not punitively.
- As the child gains experience, make sure he/she has more say in making choices and negotiating them.
- Relinquish control and encourage the child to take over some parts of the task and eventually all the task.

Grandma's button jar provided many opportunities for Ken and me to become partners in learning and enjoy the process.

Ken's ability to discriminate, compare, and contrast the distinctive features (color, shape, size, texture, number of holes) of hundreds of buttons and associate an abstract symbol (word) to describe these specific features may have contributed to his ability to learn strategies for forming categories and organizing information that provided a foundation for further learning (i.e., recognizing discrete features of print). At twelve months of age, the circuitry of his brain (neurons) was becoming organized to intermesh in a thick tangle of communication.

Ken was developing the capacity to see a letter symbol as a distinct entity and discriminate one letter from another, foundational, fundamental and necessary factors in becoming literate (Lyons, 1999). This may explain why and how Ken was able to read and write complete sentences before he was 3 1/2 years old. Some Reading Recovery students have not yet developed these complex sets of understandings nor acquired the brain circuitry and capacity to promote this learning.

Implications for Reading Recovery Teachers

Ken's experiences with Grandma's button jar demonstrate how emotional and cognitive growth are inseparable in the learning process. This finding is supported in an extensive body of neurological and psychological research (Damasio, 1994; Greenspan, 1997; LeDoux, 1996) that documents how emotions are essential to rational thinking and an inseparable part of the learning process. Unfortunately teachers oftentimes teach to develop student's cognitive skills and forget the emotional origins of intellectual development. Greenspan (1997) believes that "intellectual learning shares common origins with emotional learning" (p. 219). Gaining insights into this body of knowledge is critical to developing effective teaching practices for all children, especially those who are struggling.

Reading Recovery children enter first grade with limited prior literacy knowledge and generally a low repertoire of literacy skills. Many of these children may have missed out on rich, early childhood experiences that stimulate and support

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cognitive and emotional growth. Reading Recovery students have the capacity to learn. What they need is a teacher who knows how to help them use this capacity to learn how to learn. The following list of suggestions may be helpful in accomplishing this goal.

1) Identify and get in tune with what the child can do easily and finds difficult.
2) Create opportunities geared to the limited repertoire of knowledge the child brings to the literacy task.
3) Know how to make it easy for the child to learn.
4) Use clear, straight forward, specific, consistent language to teach the task and develop a shared understanding of this language with the child. For example, a child must understand what he/she is required to do you say "Read it with your finger."
5) Engage the child in conversations before, during, and after the lesson so that he/she has many opportunities to use language to make sense.
6) Systematically observe and evaluate what the child can do independently and use this information to help the child construct a processing system.
7) Follow the child's behavior closely, making sure he/she is active and successful.
8) Recognize, support, and praise the child's efforts and partially right responding.
9) Recognize when the task is too difficult or too easy and adjust your teaching accordingly.
10) Convey through actions and words that the child can and will learn and that you will be his/her partner in this endeavor.
11) Assume that if the child is not learning to read and write, the teacher has not yet found the right way to teach him/her.
12) Always be the child's advocate.

An extensive body of recent neuropsychological research reveals that an individual's capacity to learn depends on the quality and quantity of active involvement, interest, and exploration they have in successful learning experiences. What the teacher does, and how he/she does it, determines the nature and quality of an individual's thought processes for a lifetime.

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